Science in Alaska National Parks: Challenges and Opportunities for the 21st Century

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The need for scientific understanding of natural and cultural resources in national parks across the nation is increasing as the world continues to change around us. Nowhere in the National Park Service is this need greater than in Alaska's national parks, preserves, and monuments. Passage of the Alaska National Interest Lands Conservation Act (ANILCA) in 1980 greatly expanded the acreage managed by the NPS in Alaska. The size and remoteness of these new parks make management challenging and ongoing scientific study essential to understanding these areas.

The use of science by the NPS has recently been a topic of considerable interest *(e.g., NPS 1992, NPSAB 2001, NRC 1992, Sellars 1997)*. The history of science in Alaska parks prior to ANILCA is covered separately in this issue (see Norris article). Subsequent to ANILCA, major challenges and opportunities for the NPS science programs emerged. By the early 1990s there was a consensus among many that the NPS needed additional and better scientific research and monitoring to understand and manage potential effects from new resource issues *(NPS 1992, NRC 1992, Sellars 1997)*.

A common thread among them was a recommendation that the scientific capacity, and use of scientific information, needed to be greatly strengthened *(Figure 1)*. At the same time, a major setback to the biological research programs occurred in 1993, when many NPS research scientists were moved into a new agency, the National Biological Survey, which later became part of the U.S. Geological Survey (USGS). Even with the long-term advantages of having an independent biological science agency in the Department of the Interior, the migration of its core researchers to another agency severely taxed NPS's capacity to study and manage natural resources. Although many USGS scientists continued to conduct research of great value in parks, NPS leadership and Congress soon realized that there was a need for additional research capacity.

Congress responded by passing the National Parks Omnibus Management Act of 1998 (NPOMA). The Act included a clear research mandate and an expectation that park management would have available and use a *"broad program of the highest*

Photograph courtesy of Bob Winfree

Figure 1: Hunting is allowed for rural subsistence in most Alaska national parks, preserves, and monuments. Accurate information about Dall sheep *(Ovis dalli dalli)* and other subsistence species is important to managers working to preserve natural and healthy wildlife populations in Alaska.

Photograph courtesy of Troy Hamon

Figure 2: Working in Aniakchak National Monument and Preserve provides scientists with a special blend of challenges and rewards, as do other wild and remote parklands in Alaska.

quality science and information" (Public Law 105-391) (Figure 2). The Act specifically authorized scientific studies in parks that were ...*consistent with applicable laws and National Park Service management policies;* and ...*pose no threat to park resources or public enjoyment derived from those resources...* In addition, Congress included provisions to maintain the confidentiality of some types of information when release could result in *"unreasonable risk of harm, theft, or destruction of the resource."* The Act also authorized and directed the NPS to establish several important new scientific programs, which complemented existing efforts. These broadly increased production, utilization, and communication of scientific data and information.

Changes to NPS Science Programs in Alaska during the 1990s

During the 1990s, the NPS initiated the Natural Resource Challenge and the Beringian International Heritage Park Program in Alaska. These programs, and their components described here, will be central to an NPS Alaska Region Science Strategy now under development.

In 1990, after many years of planning by scientists and officials in two countries, U.S. President Bush and Soviet President Gorbachev announced their intention to establish a Beringian International Heritage Park to celebrate contemporary, historic, and prehistoric links between both sides of the Bering Strait. This launched what today is the Beringia Program, which supports international scientific, cultural, and educational projects, and organizes annual conferences to present project results *(Figure 3).* The program has been a major success in establishing a strong link between the landscape and cultural change across the Bering Strait, and is a testament to the value of partnerships and close cooperation with Native peoples.

In 1999, one year after passage of the NPOMA, NPS Director Robert Stanton announced the launch of the Natural Resource Challenge a new science initiative. The goals of the initiative are to identify and document park resources, determine their condition and trends, assess the implications of natural or human influenced changes, and report the findings to managers, scientists, and the public. In order to implement the Challenge, funding for science and natural resource management has increased every year since fiscal year 2000. By 2005, the funding base for natural resource and science reached $78 million more than levels prior to launching the Challenge *(NPS 2004).* In Alaska, goals were shaped into three primary objectives:

(1) to document and monitor the condition of critical park resources;
(2) to substantially reduce the backlog of resource management problems and scientific information needs; and
(3) to attract scientists outside of the NPS to work in parks *(Figure 4).*

To achieve these objectives, three programs were implemented in Alaska national parks: the Inventory and Monitoring Program, Cooperative Ecosystem Studies Units, and Science and Learning Centers.

Inventory and Monitoring Program

To meet the first objective, a national Inventory and Monitoring (I&M) program was implemented. By creating 32 networks nationally, parks were grouped into biogeographic regions. In this way, comprehensive natural resource status and trends are provided to park managers, looking across park boundaries. In Alaska, four networks were created—the Central Alaska Network established in 2001, Southwestern in 2002, Arctic in 2003, and Southeastern in 2004. Denali National Park and Preserve's pilot long-term ecological monitoring program, which began in 1991, was folded into the Central Alaska Network in 2004.

An early inventory objective was to document 90% of vertebrate animals and vascular plants in each park unit. Baseline data collection and mapping are also underway for soils, geology, water resources, water quality, air quality, and climate *(Figure 5).*

Photograph courtesy of Gregory Cuse

Figure 3: Native Chukotkan dancers performing at the 2003 Beringia Days International Conference.

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I&M scientists and data managers are developing comprehensive natural resource bibliographies for the parks, and also gathering information from historical records for relevant data to populate a series of databases. Network scientists are adopting, adapting, or developing strategies for long-term "vital sign" monitoring, and building conceptual models linking biotic and abiotic resources and natural and human-influenced processes. Vital signs are carefully selected indicators of environmental change and resource condition, such as climate, air and water quality, and the distribution and abundance of indicator plant and animal species.

Cooperative Ecosystem Studies Units

Partnerships are a key element of the Natural Resource Challenge. To facilitate collaboration with non-federal agencies, universities, and other institutions, the NPS developed agreements with the USGS and 11 other federal agencies to establish a national network of university-based Cooperative Ecosystem Studies Units (CESU). By 2004, more than 180 universities and other non-federal cooperators had joined the expanding system. Each of the 17 CESU is organized around a major biogeographic region. Alaska parks are served by two CESU—north and west Alaska and Pacific Northwest United States, which includes Southeast Alaska. In addition, since the NPS is a cooperating agency in all 17 CESU, Alaska park managers have full access to the entire CESU system of experts with special experience or knowledge.

The CESU are intended to foster partnerships in research, education, and technical assistance. The NPS supports numerous park-oriented research and technical projects in the biological, physical, cultural, and social sciences by university faculty and graduate students through the CESU. The CESU help to organize and implement scientific workshops and conferences focused on topics important to parks and other partner agencies. This creates opportunities for students to gain valuable experience working with the parks, an opportunity that sometimes launches new career paths.

Science and Learning Centers

Alaska national parks preserve some of the largest and most pristine natural areas in the United States. The daunting size of these areas (Alaska contains more than half of the acreage in the entire National Park System) and the absence of convenient road access to most sites complicates the task of outfitting and supporting field research (see Stottlemyer article, page 40). To address the remoteness and other challenges, the Natural Resource Challenge envisioned a national system of laboratory facilities, with capabilities for temporary lodging,

National Park Service photograph by Bob Winfree

Figure 4: Natural resource development on adjacent lands has accelerated our need to document resource status and trends in parks. Elevated heavy metal concentrations were detected in moss across large areas of Cape Krusenstern National Monument, apparently originating from trucks transporting lead and zinc ore concentrates on an access road through the monument.

National Park Service photograph by Pamela Sousanes

Figure 5: These climate stations are being tested in Denali National Park and Preserve, before remote deployment for the Central Alaska Network.

computer and Internet access, logistical support, research grants, opportunities for collaboration, and other benefits to the scientific community.

Two research and learning centers have now been established in Alaska, each with unique capacities. The Ocean Alaska Science and Learning Center (OASLC), located at Kenai Fjords National Park, focuses research on coastal and marine ecosystems in partnership with the Alaska SeaLife Center (e.g., harbor seal research) and others such as the Smithsonian Institution (e.g., research on early human use of Kenai Fjords, *Figure 6*). These studies and more are featured in the Kenai Fjords issue of *Alaska Park Science* (Volume 3, Issue 1). The Murie Science and Learning Center (MSLC), established in Denali National Park and Preserve in 2004, is oriented towards Alaska's inland parks. The MSLC has partnered with the Denali Institute to provide science-based learning opportunities for park visitors. Similar opportunities for children are being offered in partnership with the Denali Borough school system.

Looking Forward Into the 21st Century: A Regional Science Strategy for Alaska National Parks

Since its creation under the 1916 Organic Act, sustaining the values of national parks in perpetuity has been at the core of the National Park Service mission. Alaska park managers are in the enviable position of having stewardship over some of the most intact ecosystems and cultural sites that exist in the world today. Even so this will not protect these resources from change. While new programs implemented under the Natural Resource Challenge and Beringian International Heritage Park Program are already providing a significant base for scientific research in Alaska parks, the need for a strategic approach to science is recognized as a positive avenue for ensuring that the data collected today will inform the decisions needed in the future *(Figure 7)*.

Thus, during the fall of 2004, the Alaska Regional Office began a review of science issues, opportunities, and challenges that are expected to affect parks in the coming decades. The intended outcome of this effort will be: a strategy for expanding scientific capacity through better coordination among existing programs; increasing cooperation with scientists in other agencies and institutions; identifying short and long-term scientific information needs; organizational and infrastructure improvements needed to support data collection; and synthesis of scientific information for use in decision-making. The strategy will take a multidisciplinary approach, and will consider both terrestrial and marine *(Davis 2004)* ecosystems.

Early in this process, a series of interviews and focus group meetings were held with scientists, resource managers, educators, and senior leadership to identify key issues. Although open-ended questions resulted in a rich array of input, main themes were remarkably consistent across disciplines and staff roles. Five major issues of concern were voiced *(Table 1)*, making it clear that remoteness and low human populations cannot be relied upon to buffer Alaska parks from challenges such as climate change, transported contaminants, natural resource development in adjacent areas, and population growth in the state. These and other pressures will place NPS natural and cultural resources at potential risk in ways for which historic approaches to resource management may not suffice. Placing a "virtual fence" around park lands cannot protect their values, nor can legisla-

Climate change. Climate change is changing habitats, use of areas, accessibility, biotic communities, diseases, and causing other effects that will change the characteristics of parks as well as the type of management action required to maintain park values and mission.
Global and local contaminants. Long-range atmospheric and oceanic transport is bringing contaminants to parks with potential direct impacts on the viability of park resources, and the value of subsistence harvest. Local contaminants are being introduced through development of natural resources (e.g., mining) and use of park resources with industrial based transportation and activities (e.g., development, ATVs, boats, vehicles, hover craft).
Exotic species. Coupled with climate change and increasing use of parks, exotic species are increasingly transported to, and able to thrive in areas where they did not exist previously. This has significant impacts on natural communities.
Increasing human use. As human population continues to expand exponentially and Alaska parks become an increasing target of visitor enjoyment, subsistence and hunter use, potential impacts on natural and cultural resources increase.
Development within and surrounding parks. Park ecosystems are directly linked to surrounding areas around park boundaries. Fragmentation, contamination, loss of habitat, and overuse are likely to increase.

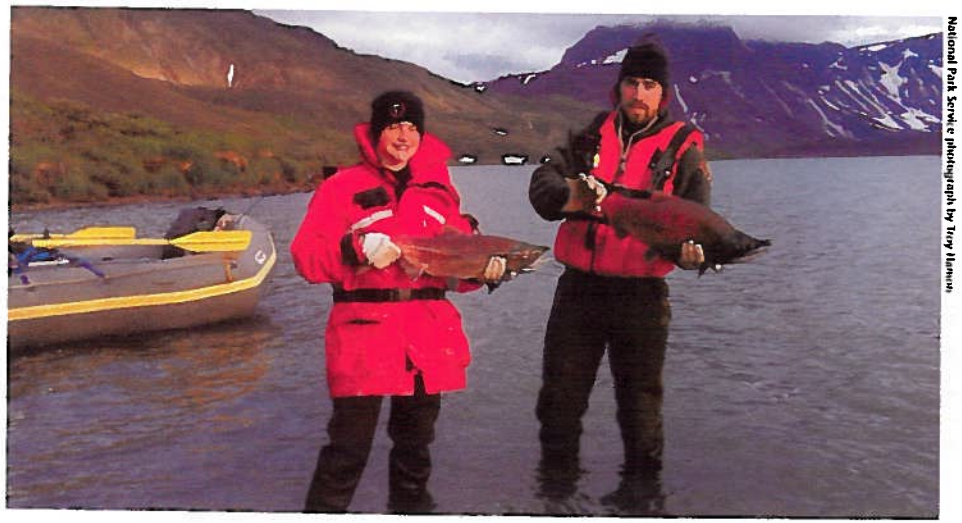
Table 1: Resource management challenges identified by National Park Service managers and scientists in Alaska.

National Park Service photograph by Jim Pfeiffenberger

Figure 6: Archeological research by the Smithsonian Arctic Studies Center and supported by the Ocean Alaska Science and Learning Center combines standard archeological techniques with traditional Native knowledge and oral history to interpret sites in Kenai Fjords National Park. Here, high school intern Katrina Dupree and her mother wet screen excavated soil to recover artifacts and bone fragments.

tive mandates (like ANILCA).

As Alaska parks increasingly face challenges such as these, the need for more deliberate and successful use of science through adaptive management will also increase *(NPS 1999)*. A regional science strategy should create new approaches for maximizing existing capacities and attracting new opportunities and partners that help us meet our goal for sustainable systems. Implementation of that strategy should help the NPS to meet its mission to preserve the nation's natural and cultural resources and ensure their enjoyment by the American people now and in future generations.



National Park Service photograph by Tony Hamson

Figure 7: Healthy salmon populations are vital to preserving Alaska's coastal ecosystems, subsistence lifestyles, and economy. Christina Olson and Bill Hobbins hold salmon during a study in Aniakchak National Monument and Preserve.

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WEB LINKS FOR PROGRAMS MENTIONED IN THE ARTICLE

Alaska Park Science Kenai Fjords issue:
www.nps.gov/akso/AKParkScience/index.htm

Beringian International Heritage Program:
www.nps.gov/akso/beringia/

Research Learning Centers
National program:
www.nature.nps.gov/learningcenters/index.html
Ocean Alaska Science and Learning Center:
www.oceanalaska.org/

Cooperative Ecosystem Studies Units
National program:
http://www.cesu.org/introduction/
North and west Alaska:
www.uaf.edu/snras/cesu/
Pacific Northwest:
www.cfr.washington.edu/research.cesu/

Inventory and Monitoring Program
National program:
www1.nature.nps.gov/protectingrestoring/im/inventoryandmonitoring.cfm
Alaska Networks:
www.nature.nps.gov/im/units/AKRO/index.htm
National databases:
http://science.nature.nps.gov/im/apps.htm